

Virginia's Largest Insect Collection – A Rich Resource for Biodiversity Information

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It is the intent with this publication to provide an assessment of the insect collections housed at Virginia Polytechnic Institute and State University and jointly maintained with the Virginia Museum of Natural History (VMNH) since 1989. We want to make available this information to the user community so that the collection records may be more fully utilized for environmental assessments (Kosztarab, 1987) and biodiversity studies in Virginia.

The collection was started by Professor William B. Alwood in 1888, and as such has become the oldest and largest continuously maintained insect collection in Virginia. A major expansion to ca 50,000 specimens occurred during 1891 to 1925 when Professor Ellison A. Smyth was curator, and also during the past 30 years with a twelvefold increase in size.

An assessment on the collection was printed 25 years ago (Covell and Kosztarab, 1966), at which time it included approximately 81,000 specimens. As the result of a number of major donations, intensive collecting in the state, and several relevant research projects, the collection now numbers approximately 862,800 specimens. The real value of the collection lies not in the number of specimens but in its quality and its unique components, given later in this article. The National Science Foundation recognized the value of the Collection for the nation with a grant in 1984.

Description of the Collection and Associated Facilities

As shown in Table 1, the insect collections at the Virginia Tech museum include 16 major orders and a few small orders. The geographic coverage for three orders is for the mid-Atlantic states, including Virginia; for nine orders it is for eastern United States; for four orders it is for the Nearctic; and for one sub-order the coverage is worldwide. This collection is unique in the eastern United States because it includes 148,429 slide-mounted specimens, 1,032 types, and 1,613 voucher specimens. Examples of the damage or malformations

produced by insects and their life stages are preserved in 540 Riker mounts. In addition, there are 1,450 plant specimens on sheets and in boxes comprising the Herbarium of Insect and Mite Damage.

The insect collection, based on its uniqueness and degree of utilization (loans, exchanges, visitors, publications, etc.), is a major resource for our active research projects, but is also considered a world resource. The productivity in terms of taxonomic publications over the past 30 years is proof that the collections are fully utilized. Our research team published approximately 120 research papers, 30 research bulletins, and four books during this time period, with a total of approximately 4,500 printed pages.

The collection is housed in the new museum building at 428 North Main Street in Blacksburg. The building is about 10,000 sq. ft. with about 2,500 sq. ft. used for housing the insect collections. There are 52 insect cabinets with 1,902 Cornell drawers, 16 metal cabinets with 1,400 vial racks filled with vials, and 640 alcohol-filled jars with shell vials. In addition, in the museum and in Price Hall (Room 301B), we house 148,492 slide-mounted insect specimens in 13 cabinets each with a 3,000 slide capacity. The main part of the general systematic entomology library is kept in the J. M. Grayson Library, Price Hall (Room 305) and includes hundreds of books and thousands of reprints taking approximately 120 linear ft. of shelf space. Specialized library material is kept in the offices and laboratories of faculty members working on the systematics of various taxa.

Unique Parts of the Collection

The collection holdings have been summarized for Coleoptera by Arnett and Samuelson (1969). The more recent acquisitions were reported in the Entomology Department Newsletters (Kosztarab, 1969-1984).

During the past thirty years the collection became a depository for voucher specimens resulting from research

by our faculty and graduate students, and serves as a reference collection for our identification services that often include insects from states other than Virginia. It is used intensively for taxonomic and biosystematic research by graduate students, faculty and visiting scientists.

The collection contains a unique Herbarium of Insect and Mite Damage, probably the first in North America. Established in 1962 (Kosztarab, 1966), it includes herbarium specimens with malformations or other characteristic and species-specific evidence produced by insects. These include leaf mines, leaf and stem distortions, discolorations, galleries of wood-boring insects, plant gall formations, leaf skeletonization, and characteristic webbing, egg masses, and malformations produced with oviposition. This unique collection provides possibilities for insect taxonomists to identify the pest species by the evidence left behind, even after the pest is long gone. Many species of plant gall makers and leafminers are easier to identify by the species-specific malformations that they produce than by the structure of the insects themselves.

The Scale Insect (Coccinea) collection is the third or fourth largest in North America. It is probably exceeded in size only by those of the National Museum of Natural History and the state collections in California and Florida. During the past thirty years it has become an internationally utilized collection for research and for deposition of type specimens of scales. The representation is international, with some special emphasis on North America, Central Europe, and Costa Rica. Types of scale insects make up the largest proportion of the total type collection. The results of our Coccinea studies, primarily based on the collection, have been published in 19 research bulletins, 3 books and in numerous other articles. This part of the collection is computerized and two hard copies of the inventory have been already published (Kosztarab and Rhoades 1985 and 1986).

Our second largest collection includes soil mites and spider mites (Acarina) with about 100,000 specimens, half on slides. We have one of the largest collections in the eastern United States, that includes material from three mite workers: L. R. Cagle, S. L. Poe, and J. A. Weidhaas. More soil mites have been recently included from our study on acid rain effects on soil arthropods.

The Coleoptera collection (with about 50,000 specimens), is one of the largest in the mid-Atlantic states. Pinned specimens are stored in 240 Cornell drawers and the alcohol preserved material fills an entire cabinet. Although we have no specialist for the group, our material was used in the preparation of research bulletins on the aquatic Hydrophilidae, Haliplidae and Dytisci-

dae. The Carabidae, Cerambycidae, and Cicindelidae are under study at present for the preparation of regional identification manuals.

The Hemiptera collection with about 13,000 specimens is among the more comprehensive in the eastern U. S., and has served as a basis for our research bulletins on the aquatic and semiaquatic Hemiptera, Coreoidea, and Pentatomoidea of Virginia.

The best representation of Lepidoptera (about 40,000 specimens) is in the collections of Geometridae and Noctuidae, which have regional significance. The geometrid genus, *Scopula*, was revised for North America in the Entomology Department in 1965, greatly benefiting our collection.

The biting midge and mosquito (Diptera: Ceratopogonidae and Culicidae) collections, with over 30,000 specimens, are among the largest in the eastern United States, and were used for revisions of the genera *Bezzia* and *Culicoides* of the Nearctic Region and Eastern U. S., respectively. Similarly, our Tabanidae and Calliphoridae collections have a good representation for the Eastern United States and provided the basis for two research bulletins in 1973 and 1977.

The aquatic insects, 38,000 specimens, are the fastest growing part of our collection at present. We have a 700-page manuscript on the dragonflies of Virginia and vicinity. Other manuscripts in preparation are on the damselflies, mayflies, stoneflies, and caddisflies of Virginia and vicinity.

The cockroach collection (Blattodea) is of worldwide coverage and includes about 3,500 preserved specimens and about 350,000 live specimens in rearing, representing about 40 species.

Other taxa that are well represented for the Eastern United States include the Acrididae, Mecoptera, Siphonaptera, and the ticks (Metastigmata). Of the estimated 20,000 species of insects in Virginia (Kosztarab, 1987) only about half are represented in the collection. Therefore, more intensive collecting is needed, especially in the biotic regions still neglected by entomologists.

Its many uses and importance of the Collection for the research, teaching and outreach programs of our University were summarized in an in-house study (Voshell et al., 1981).

Loan Policy

The length of loans is six or twelve months, unless requested for a longer period. Outstanding loans are reviewed each January. Loan requests for aquatic insects are processed by J. Reese Voshell, Jr., while dry-preserved, pinned, and slide-mounted specimens are handled

by Mary Rhoades. We encourage exchanges of duplicates. When a new species is described from our material, we expect at least one paratype to be deposited in our Museum Collection and the holotype to be deposited in the National Museum of Natural History. Loans for graduate research are given to the student's major advisor.

Utilization on an Annual Basis for the Past Five Years

Our collections are available for study to the entire scientific community. Visitors to our insect collections during 1986-1990 included 106 person (10 students) from the U. S., and 22 (4 students) from foreign countries, who spent a total of 688 days in our facilities. Loans in five years included a total of 66 (23 to students) for non-scale insects, and 22 (9 to students) for scales in the U.S., and 13 to foreign countries, with a total of about 10,990 specimens. Exchanges for a five year period included 22 on non-scale insects and 10 on scales, 9 of these to foreign countries, with a total of about 1,905 specimens. Requests for professional assistance in systematics that required the utilization of our insect reference collections included in five years a total of 295 calls. The calls counted here are in addition to the requests received by our Insect Identification Lab. That lab utilized our reference collections to provide determinations and advice (free) for 8,493 requests for help over a five-year period.

Acknowledgments

The donors of insects to the Collection have been acknowledged in the past in Covell and Kosztarab (1966), and in the Newsletters of the Department of Entomology (Kosztarab 1969-1984), therefore are not listed here. Major donations since 1985 included 6,104 specimens from Ellison A. and Mary Linda Smyth; 1,065 from Amie J. Birdwhistell; 1,437 from Noma C. Wilkinson; 22,000 from University of Richmond; and 28,474 from the author's Ohio and tropical America's scale collections.

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Table 1. Numbers of Specimens in the VMNH at VT Insect Collection (1992)

Taxa or Categories	Dry Preserved		Alcohol Preserved		Slide Mounted	Types	Voucher	Other	Geographic Coverage (No. gen/fam revised)
	Pinned	In Envelopes	Adults	Larvae					
A. <u>RESEARCH COLLECTION</u>									
Collembola	200		12,000	3,000	250				Mid-Atlantic States
Other Apterygota	40		300	150	300				Mid-Atlantic States
*Ephemeroptera	3,100	6,400	2,640	1,200	220	12	25		Eastern US (1 genus)
*Odonata	90		6,640	140		14	168		Eastern US (7 gen)
*Plecoptera	6,747		3,400	1,100	480	6	12		Nearctic
Orthoptera	1,120		1,700	110	2,100	6			Mid-Atlantic States
Blattodea	10,400		130		70				World-wide
*Hemiptera	9,400		1,900	230	180		205		Eastern US (22 f, 94 g)
Homoptera (non-scales)	700	274,400	2,400	13,000	71,834	981	10		Mid-Atlantic States
*Coccinea			70,120				724		World-wide
Neuroptera and Megaloptera	640		990	670	21				(9 fam, 32 gen)
*Coleoptera	33,325		9,900	1,340	60	5	101		Nearctic
*Trichoptera	360		10,100	2,300	110	6	90	1,500	Eastern US (3 f, 37 g)
*Lepidoptera	22,335	3,982	2,300	9,200	60				Eastern US (1)
*Diptera (non-midges)	26,285		6,800	1,700	210		156		Eastern US (1 genus)
*Ceratopogonidae	2,700		540	1,400	19,260		75		Eastern US (3 f, 36 g)
Siphonaptera	16,050		3,600	130	918		15		Nearctic (2 genera)
Hymenoptera			50,760	1,600	70	1	12		Eastern US
*Acari	980	62	2,375	5,800	48,700				Eastern US
Other Orders				845	768	1	20		Nearctic (2 f, 6 gen)
Total Research Colls.	134,382	284,844	188,595	43,915	145,611	1,032	1,613	1,500	Nearctic
B. <u>SURVEY-COLLECTION</u>	16,900		7,200	1,580					Virginia
C. <u>TEACHING COLLECTION</u>	18,780		2,800	1,450	2,800				Mid-Atlantic States
D. <u>DISPLAY CABINETS</u>	600		350	150					Virginia
E. <u>QUARANTINE COLLECTION</u>	180	80	40	30			540		World-wide
F. <u>RIKER COLLECTION</u>									Virginia
G. <u>HERBARIUM OF INSECT AND MITE DAMAGE</u>			240	25	18		1,450		Mid-Atlantic States
H. <u>LEAFMINER COLLECTION</u>									Nearctic
Grand Total	176,942	284,924	199,225	47,150	148,429	1,032	1,613	3,490	All Specimens 862,805

*Used for recent revisions and/or faunistic studies. Number of families or genera revised for publication by our workers is given in parenthesis.